

New records and four new species of Australian Thripidae (Thysanoptera) emphasise faunal relationships between northern Australia and Asia

LAURENCE A. MOUND¹ & DESLEY J. TREE²

¹CSIRO Ecosystem Sciences, PO Box 1700, Canberra, ACT 2601, Australia. E-mail: laurence.mound@csiro.au

²Queensland Primary Industries Insect Collection (QDPC), Department of Employment, Economic Development and Innovation, Eco-sciences Precinct, GPO Box 46, Brisbane, Qld 4001, Australia.

Abstract

The following Thripidae taxa are newly recorded from northern Australia, and details are given for their recognition from related taxa: *Oxythrips australopalmae* **sp. n.**, a likely pollinator of *Normanbyia* and *Archontophoenix* in Queensland but also taken on *Cocos* male flowers in New Britain; *Projectothrips beverlyae* **sp. n.** from *Pandanus* flowers; *Rhamphothrips cissus* **sp. n.** from the leaves of *Cissus antarctica*; *R. amyae* **sp. n.** from *Callistemon* leaves; *R. tenuirostris* (Karny) from *Uncaria lanosai* leaves; *R. pandens* Sakimura from *Cassytha* leaves; and *Tusothrips setiprivus* (Karny). *Trichromothrips xanthius* (Williams) is removed from the Australian list. *Tusothrips atrichotus* Reyes from the Philippines is synonymised with the widespread Asian species *T. teinostomus* Okajima. The previously unknown male of *Rhamphothrips pandens* is described from Western Australia.

Key words: *Oxythrips*, *Rhamphothrips*, *Projectothrips*, *Tusothrips*, new species

Introduction

The purpose of this paper is to record for the first time from Australia several taxa of thripine Thysanoptera that emphasise further the close faunistic relationships between northern Australia and South East Asia (Mound, 2004; Mound & Tree, 2007), and to provide information on the host associations of some of the species involved. Two species, *Rhamphothrips tenuirostris* (Karny) and *Tusothrips setiprivus* (Karny), are widespread across Asia, and *Rhamphothrips pandens* Sakimura is widespread across the Pacific. Four new species are probably Australian endemics, although one is also recorded from New Britain. This fourth new species is particularly interesting because it is specific to the flowers of two native palm trees, in which it occurs in such large numbers that it is likely to be an effective pollinator.

The information presented here is in preparation for making available, at the web site <http://anic.ento.csiro.au/thrips/>, a LucID web-based identification and information system to over 300 species of Thysanoptera Terebrantia now known from Australia. Unless stated to the contrary, all specimens discussed here are in the Australian National Insect Collection, including holotypes of the new species; paratypes are in QDPC and where possible in the Natural History Museum, London. Nomenclatural details of all thrips taxa discussed here are web-available (Mound, 2011). The authors are grateful to two anonymous referees for their careful comments, and particularly to Masami Masumoto of Yokohama for his frequent scholarly advice on systematic problems among Thripinae.

Oxythrips Uzel

Oxythrips Uzel, 1895: 133. Type-species *Oxythrips ajugae* Uzel

This genus currently comprises a series of 49 species (Mound 2011), each of which is unusual in having a single pair of major posteroangular setae on the pronotum. Of the included species, 12 are based on fossils, and all but

two of the remainder are known only from the northern hemisphere. The two exceptions are *O. skottsbergi* (Ahlgberg) from Chile, a species known only from the original inadequate description, and *O. agathidis* Morison from Queensland, Australia. The new species described below differs from most species placed in *Oxythrips* in having on tergum VIII a distinctive ctenidium-like structure antero-lateral to each spiracle (Fig. 4), and a long and regular posteromarginal comb of microtrichia, the posterior margin of this tergum usually lacking such microtrichia. *O. agathidis* is an exception in that it also has a well-developed regular comb on the eighth tergum. The new species is also unusual in that the metanotal median setae are long, arise at the anterior margin of this sclerite, and are far apart and close to the smaller lateral pair, whereas *Oxythrips* species, including *O. agathidis*, have the metanotal median setae small and placed well back from the anterior margin of this sclerite. The first vein of the forewing of the new species has a more extensive setal row than in most *Oxythrips* species, and the male has only one pair of stout setae medially on tergite IX.

Several species of the genus *Oxythrips* are associated with the plant genus *Pinus*, as are the species of the related genus *Chilothrips*. These two thrips genera appear to be strictly Holarctic, and are known only from the northern hemisphere, including India, China and Japan. Neither of the two Australian species placed in *Oxythrips* seem closely related to any of the northern hemisphere members of the genus, and these two are probably not closely related to each other. Despite this, standard identification keys will place both species as *Oxythrips*, because of the presence of a single pair of pronotal posteroangular setae. Until the thrips fauna of northern Australia and the island of New Guinea is better explored it seems best to leave these two species in *Oxythrips*, rather than to erect two new monobasic genera of doubtful affinities.

***Oxythrips austropalmae* sp. n.**

Female macroptera. Body bicoloured (Fig. 1), abdomen brown but head, thorax and legs mainly yellow; antennal segments mainly brown, I–III varying from largely brown to largely yellow; forewings shaded with base sharply paler (Fig. 7).

Head wider than long, cheeks slightly constricted behind eyes; vertex transversely striate/reticulate, including ocellar region (Fig. 3). Three pairs of ocellar setae present, pair I sometimes arising one seta in front of the other, pair III arising just within anterior margins of triangle and scarcely longer than longitudinal diameter of an ocellus; five pairs of postocular setae close to posterior margin of eye, pair I as long as ocellar setae III. Compound eyes with no pigmented ommatidia. Maxillary palps 3-segmented. Antennae 8-segmented (Fig. 2); segment I without dorsal apical setae; II–VI with rows of microtrichia: III–IV slender with apex constricted and short forked sensorium; sensoria on VI not extending beyond apex of segment.

Pronotum transversely striate/reticulate, with 30–40 small discal setae; one pair of elongate posteroangular setae, 4 pairs of posteromarginal setae (Fig. 6). Prosternal basantra without setae, ferna almost complete medially, prospinasternum transverse; sternopleural sutures absent; mesofurcal spinula present, metafurca with no spinula. Mesonotum transversely striate/reticulate; anterior campaniform sensilla present (Fig. 6); median setal pair near posterior margin. Metanotum boldly reticulate medially, laterally striate; median setae long, at anterior margin close to lateral setae; campaniform sensilla present, wide apart (Fig. 6). Forewing apex pointed; first vein setal row extending to distal third of wing, with 12 to 15 setae, then a gap to 2 setae distally; second vein with continuous setal row; clavus with 5 veinal setae, one discal seta; cilia strongly wavy (Fig. 7).

Abdominal terga without craspedum or ctenidia, but VIII with an irregular ctenidium-like row of microtrichia anterolateral to spiracle (Fig. 4); terga V–VIII with no sculpture lines mesad of setal pair S2; tergum II with sculpture lines medially between setae S1 and the campaniform sensilla; terga III–VI posteroangular setae arise distant from posterior angles (Fig. 4); VIII with long fine complete comb (Fig. 5); tergum IX anterior and posterior campaniform sensilla present (Fig. 5), mid-dorsal paired setae well developed; tergum X short with longitudinal split almost complete (Fig. 5). Sternum II with 2 pairs of posteromarginal setae, III–VII with 3 pairs, median pair on VII in front of margin. Ovipositor well-developed, strongly serrated.

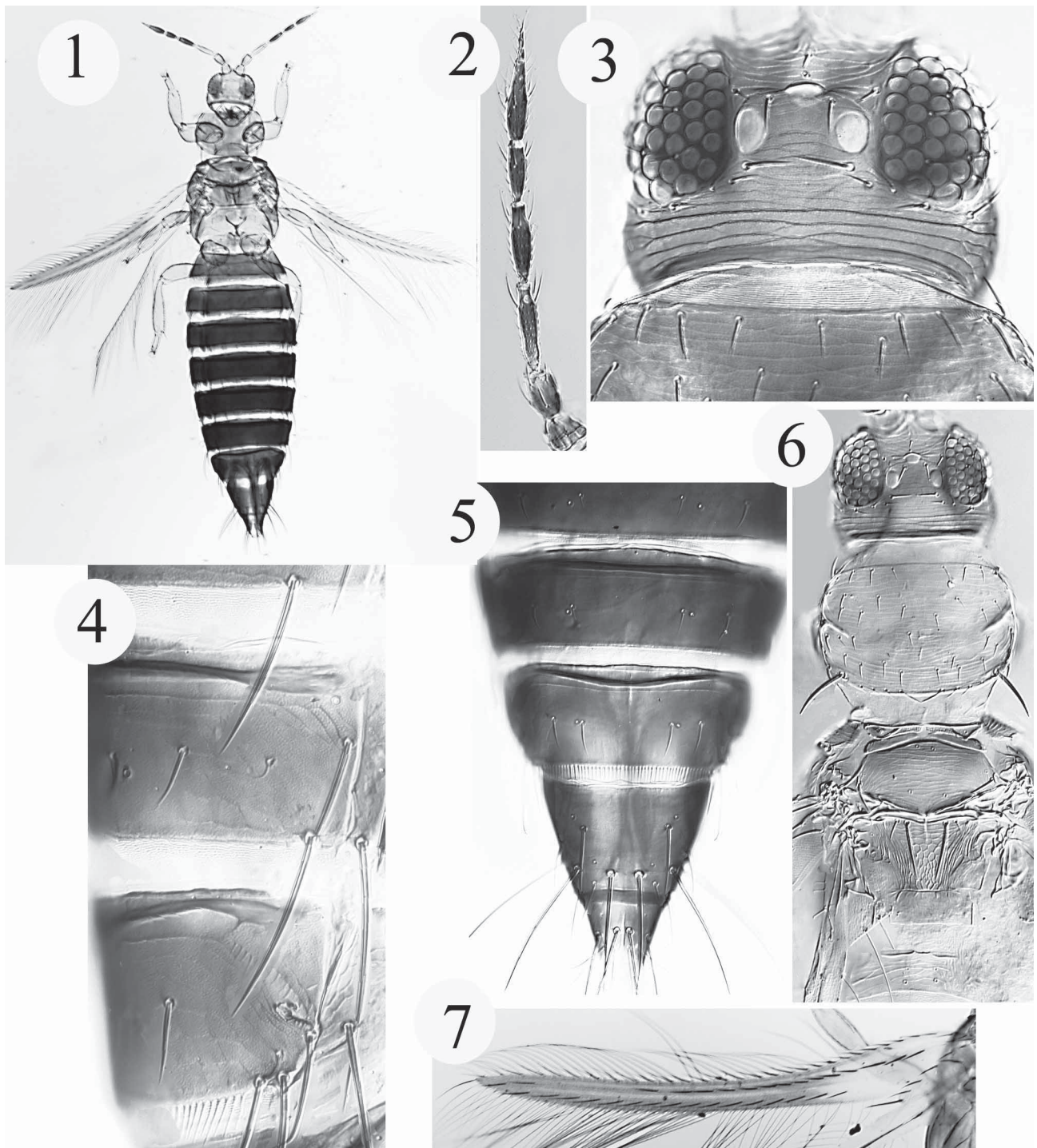
Measurements (holotype female in microns). Body length 1500. Head, length 115; median width across cheeks 165. Pronotum, length 145; maximum width 225; posteroangular setae length 65–70. Metanotal median setae length 80. Forewing length 850. Antennal segments III–VIII length, 73, 65, 48, 60, 8, 15.

Male macroptera. Similar to female but smaller, only abdominal segments VI–X brown, IV–V variable; antennal segments I–III and base of IV yellow; tergum VIII with complete comb, IX with median setal pair short and stout (Fig. 8); sterna III–VII with transversely elongate pore plate (Fig. 9).

Measurements (paratype male in microns). Body length 1200. Antennal segments III–VIII length, 65, 48, 38, 55, 8, 12.

Material studied. Holotype female, **Australia, Queensland**, Cape Tribulation, Coopers Creek, from flowers of *Normanbyia normanbyi*, 10.vii.1995 (LAM 2748).

Paratypes, 17 females taken with holotype; same locality and host, 9 females 10 males, 2.iv.2001 (S. Boulter); same locality, 17 females 7 males from flowers of *Archontophoenix alexandrae*, 9.vii.1995 (LAM 2745). **Papua New Guinea**, West New Britain, 11 females 8 males in male flowers of *Cocos nucifera*, 24.vii.1986.



FIGURES 1–7. *Oxythrips australopalmae*. (1) Female; (2) Antenna; (3) Head; (4) Terga VII–VIII posterior margin lateral view; (5) Terga VII–X; (6) Male head & thorax; (7) Wing.

Comments. This species has been found in very large numbers in the flowers of two species of palm trees in northern Queensland, also in the male flowers of coconut in New Britain. Each adult thrips was noted to carry a considerable pollen load on its surface, and judging from this the species is likely to prove to be an effective pollinator of these palm trees despite being unrecorded in the botanical literature.

***Projectothrips* Moulton**

Projectothrips Moulton, 1929: 95. Type-species *Projectothrips pruthi* Moulton

Species of this genus are highly distinctive, because of the elongate, slender, eighth antennal segment that is about nine times as long as wide (Fig. 14). Together with its generic synonym *Docidothrips* Priesner, the genus currently includes eight species. Each of these is known only from the Oriental and Pacific Regions, and they all live in the flowering spikes of *Pandanus* species (screw pines). Collecting thrips from these flowers can be particularly difficult, and thus several of the species are known from few specimens with little information on intraspecific variation. The new species described below has been taken on two different species of *Pandanus* at two widely separated localities.

***Projectothrips beverlyae* sp. n.**

Female macroptera. Body uniformly brown (Fig. 11), legs yellow; antennal segments I–II brown, II sometimes paler at apex, III–IV yellow, V brown with base sometimes paler, VI–VIII brown. Forewings shaded with paler base (Fig. 11).

Head wider than long, cheeks slightly incut behind eyes, with narrow transverse reticulation, ocellar triangle reticulate (Fig. 10). Three pairs of ocellar setae present, pair III arising on anterior margins of triangle. Five pairs of postocular setae, pair I as long as ocellar setae III, postocular setae II arising posterior to pair I and subequal in length to pair I, remaining 3 pairs in row, pairs IV–V small. Compound eyes with many small tubercles among dorsal ommatidia, no pigmented ommatidia. Maxillary palps 3-segmented. Antennae 8-segmented (Fig. 14); segment I without dorsal apical setae; II–VI with transverse rows of microtrichia; III–IV with stout forked sensorium; base of sensorium on VI oval; VIII long and slender with many fine microtrichia.

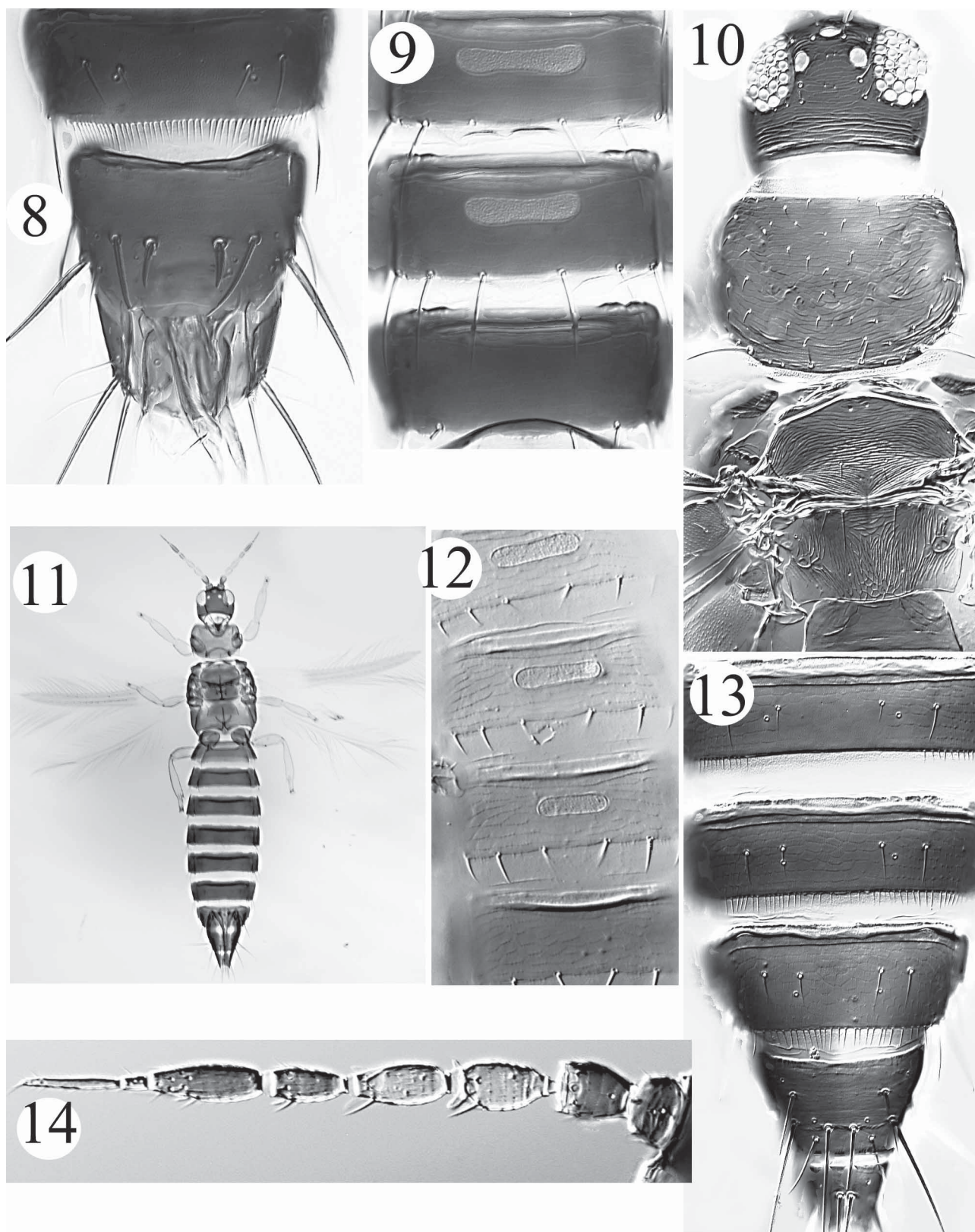
Pronotum with transverse sculpture, reticulate medially; 20–50 discal setae; one pair of elongate posteroangular setae; 3–5 pairs of posteromarginal setae, median pair longest (Fig. 10). Prosternal basantra without setae, ferna entire, prospinasternum complete; sternopleural sutures complete; meso and metafurca each with strong median spinula. Mesonotum transversely striate/reticulate with markings between major lines; anterior campaniform sensilla present (Fig. 10); median setal pair arising well in front of margin. Metanotal sculpture variable, elongate narrow reticulate/striate, usually with markings between the main lines; campaniform sensilla present, wide apart (Fig. 10). Forewing with apex pointed; costal cilia long and wavy; first vein with irregular, almost continuous setal row with distal setae more widely spaced; second vein with continuous setal row; clavus with 5–8 veinal setae, one discal seta; posteromarginal cilia strongly wavy.

Abdominal terga without craspedum or ctenidia; terga II–VI with about 7 rows of discal microtrichia laterally that extend to S2 (Fig. 13), on VII extend to setae S1, on VIII extend across tergum; III–VI with posteromarginal setal pair arising mesad of posterior angle; median setae on II–VI small and wide apart, laterally with posteromarginal comb; VII with posteromarginal comb variable, sometimes complete medially; VIII with long fine complete comb (Fig. 13). Tergum IX elongate, anterior pair of campaniform sensilla present, mid-dorsal paired setae well developed; tergum X short with longitudinal split incomplete (Fig. 13). Sterna II–VII with about 7 rows of microtrichia laterally, no discal setae, 5–6 pairs of marginal setae; ovipositor well developed and serrated.

Measurements (holotype female in microns). Body length 1790. Head, length 120; median width, across eyes 170, across checks 170. Pronotum, length 170; maximum width 230; posteroangular setae length 62–72. Metanotal median setae length 45. Forewing length 860. Antennal segments I–VIII, 25, 40, 54, 48, 36, 60, 12, 53.

Male macroptera. Similar to female but smaller and variable; antennae, pronotum, thorax and abdominal segments I–VI yellow; microtrichia on lateral and posterior margins of terga II–VII more sparse than female, VIII with

complete comb; sterna II–VI with 3 pairs of posteromarginal setae; sterna III–VI each with transversely elongate pore plate (Fig. 12).



FIGURES 8–14. *Oxythrips* and *Projectothrips*. *O. australopalmae* male 8–9: (8) terga VIII–IX; (9) sterna VI–VIII. *P. beverlyae* 10–14: (10) head & thorax; (11) female; (12) male sterna V–VIII; (13) female terga VI–X; (14) antenna.

Measurements (paratype males in microns). Body length 1200–1310. Head, length 110–120; median width, across eyes 156–160, across checks 150–160. Pronotum, length 142; maximum width 180–210; posteroangular setae length 54–56. Metanotal median setae length 29–35. Forewing length 630–660. Antennal segments I–VIII, 22–27, 33–36, 49–57, 45–47, 29–37, 48–53, 8–10, 32–38.

Material studied. Holotype female, **Australia, New South Wales**, Wooyung Beach, S28.456 E153.553, from *Pandanus tinctorius* flowers, 29.xii.2007 (DJT577).

Paratypes, 12 females taken with holotype; **Northern Territory**, Little Nourlangie, Kakadu National Park, 27 females, 15 males, from *Pandanus basedowi* flowers 21.xii.1996 (LAM3073).

Comments. This new species differs from the other members of the genus in having the metanotum reticulate/striate with markings inside each reticle, instead of linearly striate. Through the courtesy of Dr Masami Masumoto, an undescribed species has been studied from Japan, Okinawa, that is very similar but with more numerous pronotal discal setae, and more closely striate metanotum. Differences have been observed between the specimens taken from *P. basedowi* and *P. tinctorius*, but these differences are not consistent either within or between the available samples. Thus in the former sample the posteromarginal comb of microtrichia on terga VI–VII tends to be more complete, and the number of pronotal discal setae fewer than in the latter sample. There remains a possibility that each of the species of this thrips genus is specific to a particular species of *Pandanus*, but the evidence in support of this is not strong.

***Rhamphothrips* Karny**

Rhamphothrips Karny, 1913: 123. Type-species *Rhynchothrips tenuirostris* Karny.

Adults of this genus of Thripidae have a particularly elongate mouth-cone (Fig. 26) and small head (Fig. 24), and the males of some species exhibit remarkable differences in structure between large and small individuals (Tyagi et al., 2008). This type of male polymorphism is rare in Thripidae, although it is common among species of the family Phlaeothripidae that exhibit male/male competitive behaviour (Mound, 2005). Unfortunately, for none of the species of *Rhamphothrips* is there any information on the behaviour of these large and small males, and moreover there has been almost no information concerning their host associations.

The genus *Rhamphothrips* is closely related to one other Old World genus, *Exothrips* Priesner. Females of species in these two genera share one remarkable character state: on sternum VII the median two pairs of setae, S1 and S2, are close together medially, and far distant from S3, the lateral third pair (Figs 18, 30). Moreover, unlike most Thripinae, adults in these two genera have no elongate posteroangular setae on the pronotum. *Exothrips* and *Rhamphothrips* are not clearly distinguished from each other (Mound & Walker, 1987), although species of the latter have the head unusually small and the mouth cone exceptionally long, whereas species of the former have the head and pronotum transverse as in most Thripinae. Unfortunately, the apparent length of the mouth cone depends to a large extent on the orientation of slide-mounted specimens, and the species described from Africa seem to have a shorter mouth cone than those from the Oriental and Australian regions. Among the remaining Thripinae, only females of *Tusothrips* have the median two pairs of setae placed particularly close to each other (Fig. 31), but *Tusothrips* species have two pairs of prominent posteroangular setae on the pronotum (Fig. 32). Despite this, there is a tendency among species of *Anaphothrips* for the median two pairs of setae on sternite VII of females to be closer to each other than to the lateral pair.

The type species of *Rhamphothrips* was based on a single female from Java, and Bhatti (1978b) has given an account of the confusing early references to this specimen. The genus currently includes 14 species, all from the Old World tropics. Bhatti (1977) provided a key to distinguish four species from India, under the synonymic name *Perisothrips*, and Bhatti (1978b), in establishing three generic synonyms of *Rhamphothrips*, provided a full diagnosis of the genus together with a more extensive key to distinguish ten species. Subsequently, Sakimura (1983) described *R. pandens*, and this is known to be widespread from northern Australia across the Pacific and into the Caribbean. From northern India Kulshrestha & Vijay Veer (1984) described *R. santokhi* as having the posterior abdominal segments dark brown, in contrast to the uniformly yellow colour of all other members of the genus. Specimens of *R. santokhi*, identified by Richard zur Strassen and taken from flowers of *Macaranga gigantea* in Malaysia (Gombak near Kuala Lumpur), have the median pair of setae, S1, on the female seventh sternum much

smaller than setae S2, a condition also found in another Indian species, *R. parviceps* (Hood). Finally, Wang (1993) described *R. quintus* from Taiwan. Females of this species have the median two pairs of setae on sternum VII equally long (pers. comm. C-L Wang 2010), and thus similar to the condition in *R. pandens* and two further species described below from Australia (Fig. 18). However, *R. quintus* differs in that the females have a small tooth at the inner apex of the fore tibia, and the males have extensive tooth-like craspeda laterally on terga IV–VIII.

Large and small males of the new species described below from Australia differ considerably in structure. This intraspecific variation in males contrasts with the fact that females of these new species are scarcely distinguishable from each other. Males are chosen as holotypes of the two new species described below, because of the structural similarities between females. Currently it is not possible to identify many female specimens of this genus from Australia that have been collected with no associated males.

Key to *Rhamphothrips* species from Australia

1. Female sternum VII setae S1 and S2 very small, shorter than distance between their bases (Fig. 30); female fore tibia with ventral apical margin bearing two small tubercles each with one seta; metanotum closely but irregularly striate (Fig. 29); male fore coxae with hook-like tubercle posteromedially (Figs 27, 28); male terga II–VIII with toothed craspedum complete across posterior margin (Fig. 23), IX with median setal pair far apart and each arising on a small tubercle (Fig. 23) *tenuirostris*
- . Female sternum VII setae S1 and S2 longer than distance between their bases (Fig. 18); female fore tibia without ventral apical tubercles; metanotum with irregular longitudinal reticulation (Fig. 25); male fore coxae without hook-like tubercle; male tergum IX median setae different (Figs 21, 22) 2
2. Male with craspedum toothed laterally only on tergum VII (Fig. 22); male tergum IX median setae arising well separated from each other (Fig. 22); female with antennal segments IV–V largely pale with apex shaded, VI brown with base variably paler *pandens*
- . Male with craspedum toothed laterally on additional terga; male tergum IX median setae arising close together on one or a pair of small tubercles; female with antennal segment V light brown or dark brown 3
3. Females with antennal segments V–VIII almost uniformly dark brown, I–IV sharply paler than V; male terga III–VIII with craspedum prominently toothed laterally (Fig. 17); ovipositor less than 240 microns long. *amyae*
- . Females with antennal segments I–III pale, IV shaded in apical third, V–VIII light brown; male with craspedum toothed laterally only on terga VI–VII (Fig. 21); ovipositor often 270 microns long. *ciissus*

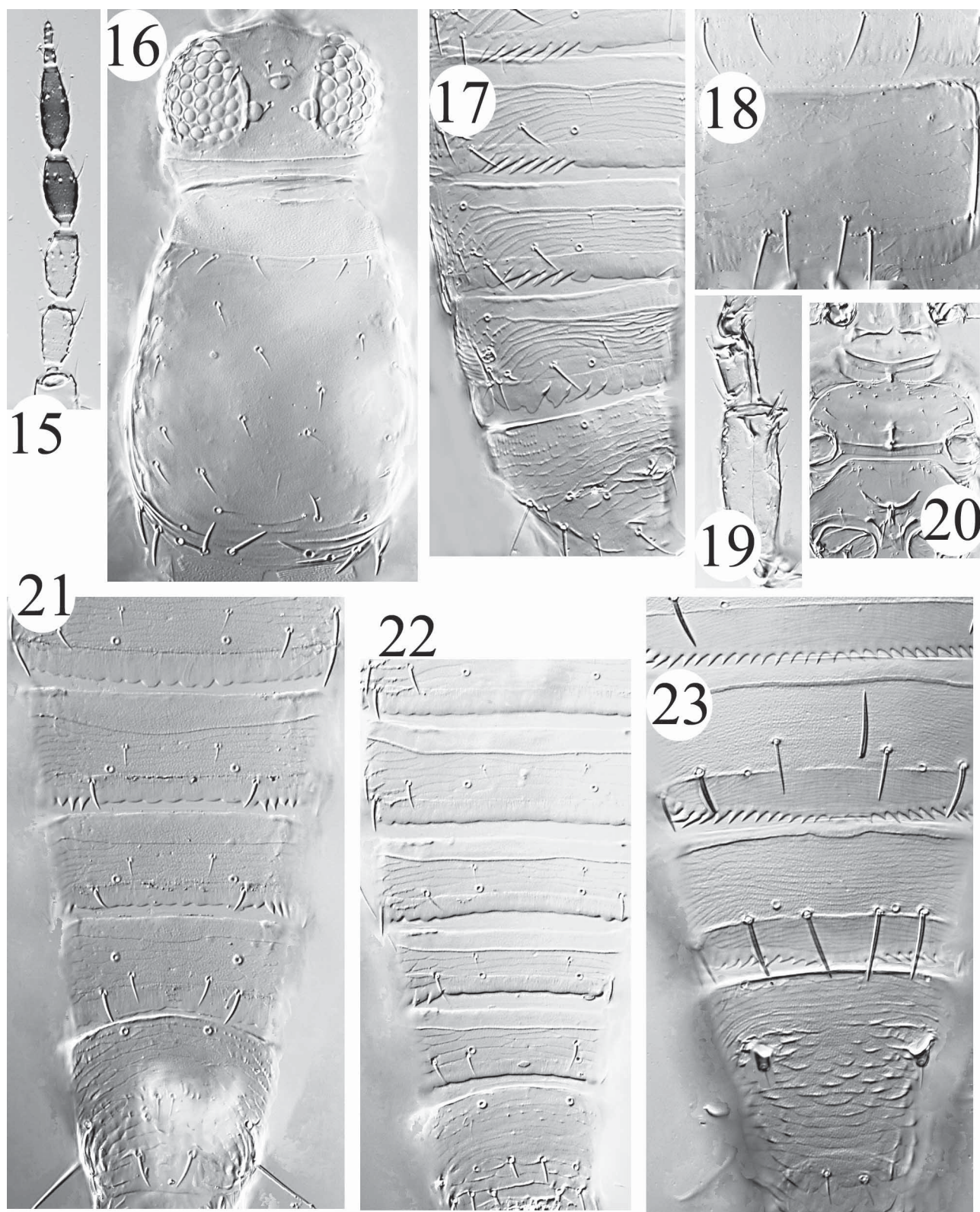
Rhamphothrips amyae sp. n.

Female macroptera. Body and legs yellow, with extreme apex of tergum X brown; antennal segments I–IV clear yellow (Fig. 15), V–VIII dark brown; forewings pale. Head small, three pairs of ocellar and two pairs of postocular setae scarcely longer than setae on compound eyes; ocellar setae III between anterior margins of hind ocelli (Fig. 16); mouth cone extending to forecoxae. Pronotum (Fig. 16) about as wide as long, narrowed to anterior, surface with little or no sculpture; posterior margin with about 6 pairs of setae, one pair of posteroangular setae slightly prominent. Mesonotal anterior campaniform sensilla present, median setae about one third of sclerite length from posterior margin, lateral pair stout. Metanotal median setae not at anterior margin, campaniform sensilla present; median area with irregular and narrow longitudinal reticulation but striate laterally. Fore tibia with two moderately stout apical setae but no tooth. Forewing slender; first vein with about 7 setae basally, 3 widely spaced setae on distal half; second vein with 4 setae; clavus with 5 veinal and one discal setae. Prosternal basantra weakly sclerotised, ferna curved forwards medially; meso and metafurca without median spinula. Abdominal terga II–VIII with weak transverse reticulation, posterior margins with broad unlobed craspedum; paired campaniform sensilla on II–VII posterior to small, widely spaced median setae; X with median split almost complete. Sterna II–VI with broadly lobed craspedum, absent medially on VII; median two pairs of setae on VII elongate.

Measurements (paratype female in microns). Body length 1160. Head, dorsal length 65; width across eyes 100; ventral length to tip of mouth cone of paratype female 195. Pronotum, length 135; maximum width 125; posteroangular major seta 30. Forewing length 520. Ovipositor length 215. Antennal segments III–VIII length 35, 32, 32, 40, 7, 10.

Male macroptera. Similar to female, but antennal segment IV weakly shaded. Fore tibia with well-developed apical tubercle (Fig. 19), fore coxa without tubercle; craspedum on tergum II unlobed, on III–VIII with large, laterally pointing, teeth but median area unlobed (Fig. 17); tergum IX medially with pair of fine setae arising from

slightly separated small tubercles, with no microtrichia laterally; sternum IX with transverse band of microtrichia.
Measurements (holotype male in microns). Body length 900. Head, ventral length to tip of mouth cone 150. Pronotum, length 125; posteroangular major seta 15. Forewing length 450. Antennal segments III–VIII length 30, 30, 28, 38, 7, 10.



FIGURES 15–23. *Rhamphothrips* species. *R. amylae* 15–19: (15) antenna; (16) head & pronotum; (17) male terga V–IX; (18) female sterna VI–VII; (19) male fore tibia & tarsus. *R. cissus* 20–21: (20) thoracic sternum; (21) male terga V–IX. *R. pandens* (22) male terga IV–IX. *R. tenuirostris* (23) male terga VI–IX.

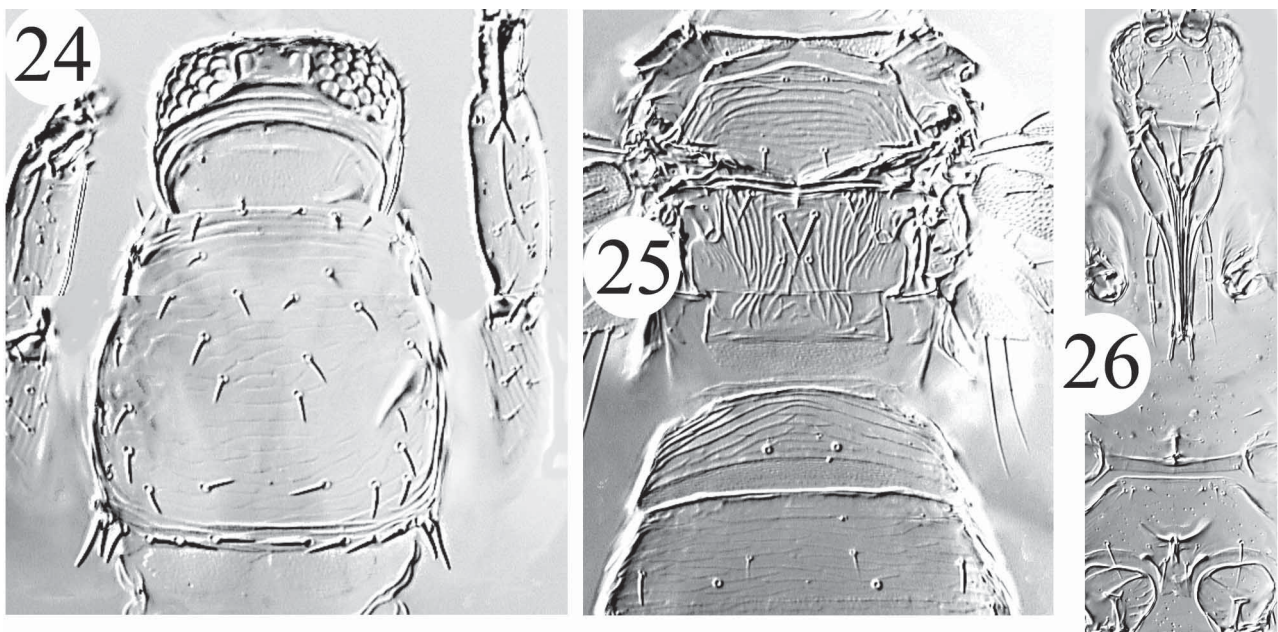
Material studied. Holotype male, **Australia, Queensland**, Carnarvon Station Reserve, from *Callistemon* shoots, iv.2007 (A. Wells 5/07).

Paratypes: **Queensland**, 9 females, 2 males taken with holotype; **Queensland**, Brisbane, Sherwood, 1 female from *Acacia* sp., 14.iii.2002.

Comments. The females of *R. amyae* are similar to those of an Indian species, *R. parviceps* Hood, in lacking any fore tibial tooth. However, in the Indian species the median setae (S1) on sternum VII are much smaller than setae S2. The females of *R. amyae* are closely similar to those of *R. cissus* in structure. They differ as follows: antennal segments V–VIII uniformly brown; mouth cone shorter, not extending beyond fore coxae; pronotum with no lines of sculpture and discal setae weak (Fig. 16); metanotum with more closely spaced lines medially; ovipositor shorter. The males are also similar to those of *cissus*, but the lateral tergal teeth are much more prominent and occur on terga III–VIII (Fig. 17).

***Rhamphothrips cissus* sp. n.**

Female macroptera. Body and legs yellow, with extreme apex of tergum X brown, antennal segments V–VIII light brown, IV shaded in apical third; forewings weakly shaded in basal half. Head and pronotum (Fig. 24), mesonotum, terga, sterna and forewing similar to *amyae*; metanotal median setae not at anterior margin (Fig. 25), campaniform sensilla present; median area with irregular longitudinal reticulation but striate laterally; fore tibia without apical tubercle; ovipositor often long, more than 270 microns.



FIGURES 24–26. *Rhamphothrips cissus*. (24) head & pronotum; (25) meso & metanotum, abdominal terga I–II; (26) mouth cone and pterothoracic sterna.

Measurements (paratype female in microns). Body length 1050. Head, dorsal length 30; width across eyes 90; ventral length to tip of mouth cone 220. Pronotum, length 130; maximum width 125; posteroangular major seta 15. Forewing length 460. Ovipositor length 275. Antennal segments III–VIII length 32, 30, 30, 38, 7, 10.

Male macroptera. Similar to female in general structure and colour, but with considerable differences between large and small males. Small male fore tibia with one apical seta arising from small tubercle; large male with tubercle larger or forming a major recurved claw with the seta arising sub-apically; fore coxa without tubercle. Terga III–V with craspeda weakly lobed medially, V or VI–VII with craspeda strongly toothed laterally (Fig. 21); tergum IX median pair of setae small, arising close together on weak median elevation, laterally with a few broadly based microtrichia. Sterna with no pore plates; sternum IX with transverse band of fine microtrichia.

Measurements (holotype male in microns). Body length 900. Head, dorsal length 30; width across eyes 85; ventral length to tip of mouth cone 175. Pronotum, length 120; maximum width 120; posteroangular major seta 18. Forewing length 410. Antennal segments III–VIII length 30, 30, 30, 35, 7, 10.

Larva II. Yellow, tergum X dark on posterior half, antennal segments lightly shaded; abdominal terga each with three pairs of setae with broadly capitate and fimbriate apices, similar setae on head and thorax.

Material studied. Holotype male, **Australia, New South Wales**, Kiama, Jamberoo Mt Rd, from *Cissus antarctica* leaves, 3.xi.2002 (LAM 4206).

Paratypes, all from *Cissus antarctica*: **New South Wales**, 5 females, 1 male taken with holotype (also several larvae); Dorrigo, 2 females, 22.iii.1995; Narara, 3 females, 2 males, 16.viii.1995; Taree, Lansdowne, 1 female, 2 males with larvae, 13.iv.2002. **Queensland**, Brisbane Forest Park, 4 females, 4 males, 16.i.2006; same locality, 2 females, 1 male, 29.x.2008; Mt Nebo, 3 females, 30.x.2007.

Comments. Apparently host specific to the young terminal leaves of *Cissus* (Vitaceae), females of this species are similar to those of *R. amyaе* although the males are readily distinguished. The females are also similar to an Indian species, *R. parviceps* Hood, in lacking any fore tibial tooth, but differ in that both S1 and S2 setae on sternum VII of females are elongate. Bhatti (1977: 576) refers to a species in India from *Acacia suma* that was misidentified by Ramakrishna (1928) as *parviceps*. Judging from specimens studied recently from *Acacia nilotica* in Tamil Nadu, this undescribed species shares with *cissus* the dark antennal segments V–VI and equally long setae on sternum VII. However, the ovipositor is only 225 microns long in these specimens, whereas it is usually (but not always) far longer in *R. cissus*.

***Rhamphothrips pandens* Sakimura**

Rhamphothrips pandens Sakimura, 1983: 299–303

This species was described from Hawaii, Jamaica and Florida, but subsequently has been recorded from various Pacific islands: Kiribati (Mound & Walker, 1987); New Caledonia (Bournier & Mound, 2000); French Polynesia (Hoddle et al., 2008). Reference material used for the present study included specimens from Kiribati that previously had been compared to type specimens (Mound & Walker, 1987). Females apparently identical to these reference specimens are listed below from several localities in northern Australia. One female (in ANIC) collected in Thailand in 2003 has also studied. In contrast, females listed below from near Broome, Western Australia, have the pronotal discal setae slightly weaker, but with no further apparent differences. Males of this species have not previously been known, and have been found only amongst these Western Australian series. From this occurrence of males it is concluded that *pandens* probably originated in Australia, and that a female-only strain with limited variation has been distributed across the Pacific to the Caribbean. The species appears to be polyphagous, although the only plant from which larvae have been taken together with adults was a species of *Cassytha* (Lauraceae), a genus of parasitic scrambling vines that is widespread across Australia.

Female macroptera. Very similar in colour and structure to *cissus* and *amyaе* described above; antennal segments IV–V largely pale with apex shaded, VI brown with variable pale area basally. Ovipositor length scarcely more than 200 microns.

Male macroptera. Similar to female, but antennae paler, segment VI largely yellow. Fore tibial armature similar to large and small males of *cissus*; terga laterally without prominent teeth, VII with a few small tooth-like lobes (Fig. 22); tergum IX with median pair of setae arising separately, further apart in large male than in small male, with no microtrichia laterally; sterna VIII and IX with transverse band of microtrichia.

Larvae II. Yellow, tergum X dark on posterior half, antennal segments lightly shaded; abdominal terga each with three pairs of setae with broadly capitate and fimbriate apices, similar setae on head and thorax. Pupae with setae finely acute.

Australian material studied. **Northern Territory**, Coburg Peninsula, Smith Point, 1 female from *Ficus* leaves, 14.v.1999. **Queensland**, Boigu Island, 1 female, 16.xi.2009; Yam Island, 2 females, 19.xi.2009; Cairns, James Cook University, 2 females from *Glochidion sumatrana* leaves, 3.xi.2008. **Western Australia**, 150km south of Broome, 6 females, 6 males with larvae from *Cassytha* leaves, 3.iii.2005; Broome, 5 females, 2 males from *Sida* leaves, 28.ii.2005.

***Rhamphothrips tenuirostris* (Karny)**

Rhynchothrips tenuirostris Karny, 1912: 297

Females of this species can be recognised by the condition of both median pairs of setae on sternum VII being minute (Fig. 30), scarcely twice as long as their basal pores. This contrast with the condition mentioned above in two species from India, *R. santokhi* and *R. parviceps* in which only the median of these two pairs of setae, S1, is minute and thus much smaller than setae S2, and all other members of the genus in which both pairs of setae are long (Fig. 18). Bhatti (1978b) distinguished the Indian species *R. aureus* (and its synonym *R. hartwigi*) from *R. tenuirostris*, described from Java, on character states that appear to be related to body size. These differences may not be valid, because the number and size of the lateral setae on the mesosternum differ considerably between the largest and smallest males listed below from *Uncaria lanosa* in Australia (Figs 27, 28). Bhatti (1977) provided clear illustrations of the male genitalia of *R. aureus*, indicating that the phallus bears a pair of upward pointing spikes. Males from *Uncaria* in Australia that are here identified as *R. tenuirostris* have the phallus essentially similar to those illustrations. Terga I–VIII of *aureus* were described as “completely sculptured with transverse anastomosing lines” and similar but faint lines are visible in specimens from Australia. On tergum IX of the Australian males there is a pair of small, widely separated, tubercles (Fig. 23), and ventrolaterally there is a group of stout microtrichia.

Material studied. **Australia, Queensland**, Redlynch, Crystal Creek, 12 females, 6 males from leaves of *Uncaria lanosa* (Rubiaceae), 5.xi.2008 (LAM 5192; DJT 789); Kuranda, 2 females from *Grevillea baileyana*, 7.xi.2008; Cairns, James Cook University Campus, 1 female from leaves of Euphorbiaceae tree, 3.xi.2008; Badu Island, 1 female, 1 male from grasses, 18.xi.2009.

***Trichromothrips* Priesner**

Trichromothrips Priesner, 1930: 9. Type species *Trichromothrips bellus* Priesner

There are 33 species listed in this genus (Mound, 2011), almost all from tropical Asia, and an illustrated key to these was provided by Bhatti (2000). Four species are listed from Australia (Mound, 2008), but one of these is here deleted from the Australian list. Moreover, a few specimens taken in various parts of northern Australia are available in ANIC representing further unidentified species.

***Trichromothrips xanthius* (Williams)**

Taeniothrips xanthius Williams, 1917: 59

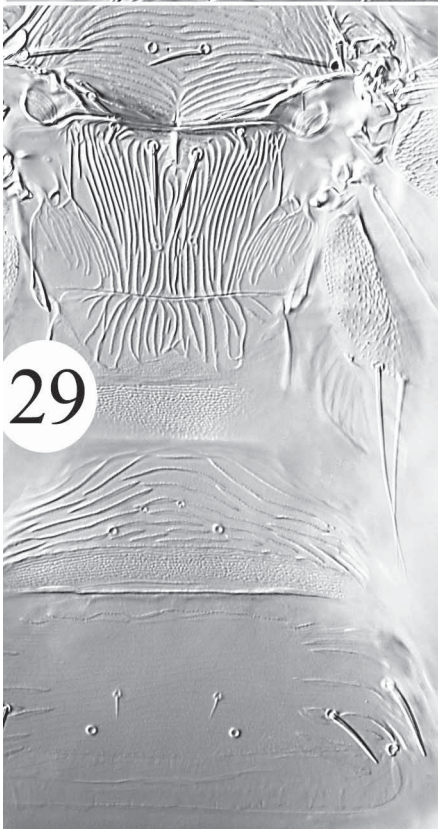
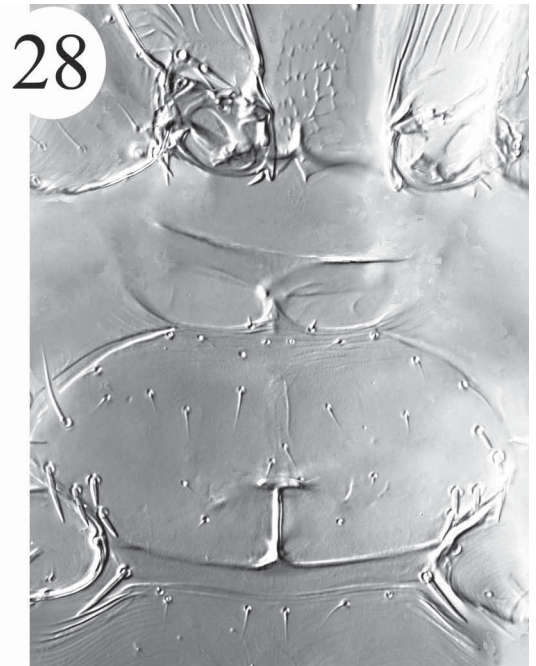
This species was recorded from Australia by Sakimura (1955: 597). However, this record was based solely on specimens intercepted in quarantine in North America. No specimens of the species are known from Australia, and there is currently no justification for listing it as occurring on this continent.

***Tusothrips* Bhatti**

Tusothrips Bhatti, 1967: 16 Type species *Mycterothrips pseudosetiprivus* Ramakrishna & Margabandhu

Species of the genus *Tusothrips* have 8-segmented antennae without a pair of dorso-apical setae on segment I; the head is small with ocellar setae pair I absent, but the mouth cone reaches the mesosternum; the transverse pronotum has two pairs of prominent posteroangular setae (Fig. 32); each abdominal tergum bears a broad craspedum on the posterior margin; sterna III–VI bear a craspedum of broad lobes, and sternal setae S1 and S2 are close together medially on VII (Fig. 31).

Six species are currently listed in this genus (Mound, 2011), but each of these is known from few specimens, and the character states on which they are distinguished may not be reliable. *T. sumatrensis* (Karny), the senior



FIGURES 27–32. *Rhamphothrips* and *Tusothrips*. *R. tenuirostris* 27–30: (27–28) large and small males, fore coxae and mesos-ternum; (29) meso & metanotum and abdominal terga I–II; (30) female sternum VII. *T. setiprivus* 31–32: (31) female sternum VII; (32) head, thorax and abdominal terga I–II.

synonym of the type species of the genus, has a recorded range from India to the Philippines. This species and *T. calopgomi* (Zhang) from southern China are similar in having a dark marking transversely across the forewing, with the entire clavus equally dark; these two possibly represent the same species. In contrast, the forewings of the other four species are uniformly pale, or with only a weakly shaded mark. Amongst these, *T. teinostomus* Okajima from Thailand is distinct in having the sensorium on antennal segment VI with an elongate base, and Okajima (1990) also recorded this species from Indonesia and the Philippines. The published illustration of *T. atrichotus* Reyes, based on three females from the Philippines, implies that the sensorium on segment VI of that species has a narrow base, but recent examination of the holotype (in ANIC) has shown that the base of this sensorium is actually elongate. Therefore, *T. atrichotus* is here considered to be the same as *T. teinostomus* **syn.n.** In two species, *T. immaculatus* and *T. setiprivus*, the mesosternal furcal spinula is present, but in *T. calopgomi* and *T. teinostomus* this spinula is absent, whereas among the available specimens of *T. sumatrensis* this structure varies in its development.

Tusothrips setiprivus (Karny)

Mycterothrips setiprivus Karny, 1927: 200

This species was described from a single female taken in Coimbatore, India, and only one female, collected in West Bengal, has been recorded subsequently (Bhatti, 1978a). The two females listed below were identified as *T. setiprivus* after comparison with the holotype at the Senckenberg Museum, Frankfurt, and these new records considerably extend the known range of the species. *T. immaculatus* Reyes was described from three females taken at Mindanao, Philippines (Reyes, 1994). The description distinguished this by the presence of a few microtrichia laterally on the posterior margin of tergum VIII, and by the lack of a longitudinal split on tergum X. However, neither of these character states is adequately visible in the holotype of *T. setiprivus* because this is ventrally-mounted. The two females identified here as *T. setiprivus* have no microtrichia on the craspedum of tergum VIII, and there is a longitudinal split on tergum X. Recent examination of the holotype of *T. immaculatus* (in ANIC) has shown that tergum X has a similar dorsal longitudinal split, but that the posterior margin of tergum VIII bears two or three microtrichia on the craspedum near its lateral extremities. These two names possibly represent a single species, but the mouth cone of *T. immaculatus* appears to be considerably longer than that of *T. setiprivus*.

Material studied. **Australia, Northern Territory**, Coburg Peninsula, Smith Point, 1 female from dead twigs, 14.v.1999 (LAM 3698). **Thailand**, Chiang Mai Province, 1 female from *Sida acuta*, 6.viii.1999 (AD Wright).

References

- Bhatti, J.S. (1967) *Thysanoptera nova Indica*. 24 pp. Published by the author, Delhi.
- Bhatti, J.S. (1977) The genus *Perisothrips* in India. *Oriental Insects*, 11, 567–577.
- Bhatti, J.S. (1978a) A revision of Karny's species of *Anaphothrips* of the Oriental region. *Oriental Insects*, 12, 1–27.
- Bhatti, J.S. (1978b) Studies in the systematics of *Rhamphothrips*. *Oriental Insects*, 12, 281–303.
- Bhatti, J.S. (2000) Revision of *Trichromothrips* and related genera (Terebrantia: Thripidae). *Oriental Insects*, 34, 1–65.
- Bournier, J.P. & Mound, L.A. (2000) Inventaire commenté des Thysanoptères de Nouvelle-Calédonie. *Bulletin de la Société Entomologique de France*, 105, 231–240.
- Hoddle, M.S., Hoddle, C.D. & Mound, L.A. (2008) An inventory of Thysanoptera collected from French Polynesia. *Pacific Science*, 62, 509–515.
- Karny, H. (1912) Zwei Neue javanische Physapoden-Genera. *Zoologischen Anzeiger*, 40, 297–301.
- Karny, H. & Docters van Leeuwen-Reijnvaan, W. & J. (1913) Beiträge zur Kenntnis der Gallen von Java. 5. Über die javanischen Thysanopteren-ecidien und deren Bewohner. *Bulletin du Jardin Botanique de Buitenzorg* 10, 1–126.
- Karny, H. (1927) Studies on Indian Thysanoptera. *Memoirs of the Department of Agriculture in India. Entomology Series*, 9, 187–239.
- Kulshrestha, S.K. & Vijay Veer (1984) Two new species of Thysanoptera (Insecta) from India. *Bulletin of Entomology*, 25, 33–37.
- Moulton, D. (1929) Thysanoptera from India. *Records of the Indian Museum*, 31, 93–100.
- Mound, L.A. (2004) Australian Thysanoptera – biological diversity and a diversity of studies. *Australian Journal of Entomology*, 43, 248–257.
- Mound, L.A. (2005) Fighting, flight and fecundity: behavioural determinants of Thysanoptera structural diversity. Pp 81–105

- in Ananthakrishnan TN & Whitman D. [eds] *Insects and phenotypic plasticity*. Science Publishers Inc. Enfield, NH, USA.
- Mound, L.A. (2008) Order Thysanoptera in Australian Faunal Directory, Australian Biological Resources Study. <http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/THYSANOPTERA>.
- Mound, L.A. (2011) Thysanoptera (Thrips) of the World - a checklist. <http://www.ento.csiro.au/thysanoptera/worldthrips.html> [accessed 10.i.2011]
- Mound, L.A. & Tree, D.J. (2007) Oriental and Pacific Thripidae (Thysanoptera) new to Australia, with a new species of *Pseudodendrothrips* Schmutz. *Australian Entomologist*, 34, 7–14.
- Mound, L.A. & Walker, A.K. (1987) Thysanoptera as tropical tramps: new records from New Zealand and The Pacific. *New Zealand Entomologist*, 9, 70–85.
- Okajima, S. (1990) Two thripine species collected on egg-plant in Thailand (Thysanoptera, Thripidae). *Bulletin of the Biogeographical Society of Japan*, 45, 71–75.
- Priesner, H. (1930) Contribution towards a knowledge of the Thysanoptera of Egypt, III. *Bulletin de la Société Royal Entomologique d'Egypte*, 14, 6–15.
- Ramakrishna, T.V. (1928) A contribution to our knowledge of the Thysanoptera of India. *Memoirs of the Department of Agriculture of India*, (Entomology Series 10) 7, 217–316.
- Reyes, C. (1994) Thysanoptera (Hexapoda) of the Philippine Islands. *The Raffles Bulletin of Zoology*, 42, 1–507.
- Sakimura, K. (1955) A revision of the genus *Dichromothrips* Priesner. *Proceedings of the Hawaiian entomological Society*, 15, 583–600.
- Sakimura, K. (1983) A new *Rhamphothrips* from Hawaii, Jamaica and Florida, and notes on *R. pomeroi* (Thysanoptera: Thripidae). *Proceedings of the entomological Society of Hawaii*, 24, 299–303.
- Tyagi, K., Kumar, V. & Mound, L.A. (2008) Sexual dimorphism among Thysanoptera Terebrantia, with a new species from Malaysia and remarkable species from India in Aeolothripidae and Thripidae. *Insect Systematics and Evolution*, 39, 155–170.
- Wang, C.-L. (1993) A new species, *Rhamphothrips quintus* (Thysanoptera: Thripidae) from Taiwan. *Chinese Journal of Entomology*, 13, 341–345.
- Williams, C.B. (1917) A new thrips damaging orchids in the West Indies. *Bulletin of Entomological Research*, 8, 59–61.
- Uzel, J. (1895) *Monograph on Thysanoptera*. Hradec Králové. Kvart, 500 pp (in Czech & German) <http://www.archive.org/details/monografieraduth00uzel>.